International Association of Geodesy

(IAG)

2003-2007

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The Three Pillars of Geodesy

• Modern geodesy is based on
  – geometry and kinematics,
  – Earth orientation and rotation, and
  – gravity field and its variability.

• Polar motion, one aspect of Earth rotation, cannot be predicted accurately and therefore must be continuously monitored.

• The gravity field and the terrestrial system are not strictly stationary either. Therefore, monitoring is a central issue in geodesy.
Motivation for a new IAG

• Geodesy went through a (r)evolution in the 2\textsuperscript{nd} half of the 20\textsuperscript{th} century:
  – space age & space geodesy
  – age of computers
  – new understanding of IAG services (IGS, IERS)

• IAG Structure in essence stable since 1951!
Development of new IAG

• The new IAG Statutes and Bylaws were accepted at IAG Scientific Assembly in Budapest (September 2001).

• New elements:
  – four scientific Commissions
  – IAG Services on same level as Commissions
  – The IAG project IGGOS
  – IAG Outreach Branch
  – Inter-commission Committees, Individual membership
The IAG Services

• Monitoring of global phenomena is a difficult task. In IAG such tasks are treated by Services.

• IAG is willing to establish a service, provided
  – there are clearly defined products and
  – an important user community.

• In IAG it makes sense to distinguish
  – geometry-related services
  – gravity-related services.
The IAG Services in 2003

• **Geometry-related services**
  – PSMSL (1933), joint with IAPSO
  – Time section of BIPM (1988), Successor of BIH (1912),
  – IERS, Earth Rotation (1989), Successor of IPMS (1960), ILS (1899),
  – IGS, International GPS Service (1994),
The IAG Services in 2003

• **Gravity-related services**
  – ICET, Earth Tides (1956)
  – BGI, Bureau Gravimetrique (1951)
  – IGeS-1, Geoid Service (1991)
  – IGeS-2, Geoid Service (NIMA)
  – *not* the ILRS (!)

• Documentation is important, as well ...
  – IBS, Bibliographic Service (1889)
  – IIS, Information Service
Monitoring Earth Rotation

- Monitoring the Earth’s rotation always was an interdisciplinary task, containing geodetic and astronomical aspects.
- It became more and more complex in the 20th century -- atmosphere sciences and oceanography had to be included, as well.
- The task was initially handled by the ILS, then by the IPMS, and eventually by the IERS.
ILS, IPMS, IERS: A Case Study

• The ILS was founded in 1899 as a service of IAG to monitor polar motion
  – using the astrometric observation technique
  – to determine latitude variations
  – of a network of six observatories at a Northern latitude of about 39°.

• The celestial system was given by the fundamental catalogs, the (mean) site coordinates by geodesy.
ILS, IPMS, IERS: A Case Study

• The IAG Central Bureau was initially located at the Geodetic Institute of Potsdam.

• F.R. Helmert was the first Director of the IAG-CB.

• The Institute also acted as CB for the ILS with C.T. Albrecht as head.
ILS, IPMS, IERS: A Case Study

- The ILS (left) was capable of monitoring PM with about 100mas.
- The IPMS (center) did the same (with the same methods) with an accuracy of few 10mas.
- The IERS does the same with < 0.1 mas accuracy.
The IGS: A Case Study

• The *International GPS Service* IGS, developed 1989-1993, established in 1994, produces
  – GPS orbits of few cm-accuracy,
  – Clock corrections,
  – Dense global reference frame (sub-cm, -mm/y),
  – Earth Rotation Parameters (PM, lom),
  – Global ionosphere models,
  – Valuable tropospheric information,
  – …

• and develops into a general *GNSS Service*. 
The IGS: A Case Study

- The IGS Tracking Network in 2003
• GPS Orbit Quality w.r.t. official product
IGS Coordinates & Velocities
The IGS: A Case Study

• IGS Ionosphere Maps available since 1995
Future of the Services

• The services will continue to play a decisive role within IAG.

• The challenge of the near future is the achievement of the $10^{-9}$ consistency of geometry and gravity (including of course Earth rotation).

• The IGGOS, the new IAG’s first Project, should achieve this goal with the services!
IGGOS Definition

- **IGGOS** stands for *Integrated Global Geodetic Observing System*.
- **IGGOS** monitors the Earth system as a whole through the IAG Services.
- **IGGOS** is based on the 3 pillars of geodesy
  - *geometry and kinematics*,
  - *Earth orientation and rotation*, and
  - *gravity field and its variability*
• Missions CHAMP, GRACE (above), GOCE mark beginning of a new era for gravity field determination
IGGOS Vision

• IGGOS provides geodesy’s contribution to Earth sciences.

• IGGOS integrates the work of IAG and is the bridge to the other geosciences.

• IGGOS is IAG’s flagship.
Initial IGGOS Structure

• These *general principles* are observed:
  – IGGOS is based on the existing IAG Services.
  – IGGOS is *not* taking over tasks of the well working IAG services.
  – New IGGOS entities will be established only if there is a stringent requirement.
Initial IGGOS Structure

• **Key elements** of the initial IGGOS structure:
  – *IGGOS Program Board* as the central oversight entity.
  – *Working Groups* with tasks independent of those of the IAG services.
  – *Science Council* representing the geodetic community.
Initial IGGOS Structure

- **Participating Organizations**
- **IGGOS Program Board** (Members from Participating Organizations)
  - **WG on Strategy and Funding**
  - **WG on User Integration**:
    - Science
    - Industry
    - Authorities
  - **WG on Copyright, Data Access Policy, Publishing and Certification**
  - **WG on Data, Metadata and IGGOS Product Standards**
  - **WG on IAG Services**
  - **WG on Integration of IGGOS in IUGG Entities**
IGGOS Schedule 2003-2005

- IGGOS Definition Phase 2003-2005
  - Define structure of the “final” IGGOS Project.
  - Develop IGGOS Science Plan.
- Prof. Chris Reigber is presiding the IGGOS Project for definition phase 2003-2005.
- Review of IGGOS Project by IAG EC at IAG Scientific Assembly 2005.
- Start of IGGOS Project on October 1, 2005.